

Sicyopus (Smilosicyopus) sasali, a new species of freshwater goby from Futuna Island (Gobioidei: Sicydiinae)

by

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ABSTRACT. - *Sicyopus (Smilosicyopus) sasali* n. sp., a carnivorous freshwater goby, is described from eight specimens (3 males, 5 females) collected in high gradient streams of Futuna Island, situated in the South Pacific, between Samoa and Fiji. *S. sasali* differs from other species of the subgenus *Smilosicyopus* by the following combination of characters: more scales in lateral series (24-47), transverse back series (3-13) and transverse forward series (0-13); less scales in zigzag series (11-14); a greater length of anal fin; a shorter preanal length; and a shorter caudal peduncle.

RÉSUMÉ. - *Sicyopus (Smilosicyopus) sasali*, une nouvelle espèce de gobie d'eau douce de l'île de Futuna (Gobioidei: Sicydiinae).

Sicyopus (Smilosicyopus) sasali, n. sp., un gobie carnivore dulçaquicole, est décrit à partir de 8 exemplaires (3 mâles, 5 femelles) collectés dans les rivières de l'île de Futuna, située dans le Pacifique sud, entre les Samoa et Fidji. Cette espèce diffère des autres espèces du sous-genre *Smilosicyopus* par plusieurs caractères : un plus grand nombre d'écailles en ligne latérale (24-47), en série transverse postérieure (3-13) et en série transverse antérieure (0-13) ; moins d'écailles en série zigzag (11-14) ; une nageoire anale plus longue ; une longueur préanale plus courte et un pédoncule caudal plus court.

Key words. - Gobiidae - Sicydiinae - *Sicyopus sasali* - Futuna Island - Freshwater - New species.

During the past 25 years many freshwater gobies, including those of the subfamily Sicydiinae Gill, 1860, usually considered to belong to Gobiidae, have been collected and identified from freshwater streams throughout the tropical Indo-Pacific. Approximately 50 new species of Sicydiinae have been described from the Pacific region since 1979 (Watson *et al.*, 2001).

With the beginning of the studies by the National Museum of Natural History of Paris (MNHN) in freshwaters of Pacific area, many islands have been prospected: New Caledonia (Keith *et al.*, 2000, 2002c; Watson *et al.*, 2001, 2002; Marquet *et al.*, 2003), Vanuatu, French Polynesia (Keith and Vigneux, 2002; Keith *et al.*, 2002a, 2002b, 2004a, 2004b) and, recently, Wallis and Futuna.

The freshwater ichthyofauna of Futuna, a small island situated between Fiji and Samoa, was completely unknown until October 2004, when a freshwater survey was conducted by the University of Perpignan, the MNHN, ETHYCO and the CEMAGREF. This small island (84 km²) is partly covered with a primary forest, has a maximum high of 524 m and the rivers are short (maximum 3 km long). During this study, 18 species of freshwater fishes were found and, among them, a new species of *Sicyopus*.

Watson (1999) recently defined three subgenera (*Juxtastiphodon*, *Smilosicyopus* and *Sicyopus*) as belonging to *Sicyopus* Gill, 1863, based largely on dental characteristics found in both jaws. *Juxtastiphodon* has conical teeth in both jaws

crowded closely together, none recurved and without canines. *Sicyopus* has widely spaced conical teeth in both jaws with most sharply recurved and without canines. *Smilosicyopus* has slightly recurved conical teeth anteriorly in both jaws, laterally needle-like teeth with none recurved, between anterior and lateral teeth, at least one (1-3) canine tooth, well developed in males.

The new species is in the subgenus *Smilosicyopus*, which currently includes *Sicyopus (Smilosicyopus) leprurus* Sakai & Nakamura, 1979; *Sicyopus (Smilosicyopus) bitaeniatus* Maugé, Marquet & Laboute, 1992; *Sicyopus (Smilosicyopus) fehlmanni* Parenti & Maciolek, 1993; *Sicyopus (Smilosicyopus) mystax* Watson & Allen, 1999 and *Sicyopus (Smilosicyopus) chloe* Watson, Keith & Marquet, 2001. *Smilosicyopus* is known from the Andaman Islands (Indian Ocean) to the Marquesas Islands and southern Japan to New Caledonia in swift clear, high gradient streams with rocky and boulder strewn bottoms.

The purpose of the current study is to provide a description of *Sicyopus (Smilosicyopus) sasali* n. sp., a freshwater goby found in Futuna Island.

METHODS

Methods follow Watson (1995). Measurements were taken with a dial caliper to the nearest tenth of a millimetre.

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All counts were taken from the right side. The size is given in standard length (SL). Teeth were counted to the right of symphysis. Abbreviations for institutions and collections cited follow Leviton *et al.* (1985), except LICPP, which is now BLIH (Biological Laboratory, Imperial Household, Akasaka Imperial Palace, Tokyo) and CMK (Collection of Maurice Kottelat, Cornol, Switzerland). Abbreviations for the cephalic sensory pore system follow Akihito (1986).

Comparative material

Sicyopus (Smilosicyopus) bitaeniatus Maugé, Marquet & Laboute, 1992. - Marquesas Islands: MNHN 1992-113, female (34.4 mm), MNHN 1992-115, 2 males, 8 females (21.3-33.6 mm); Hiva Oa: Vaioa River, 7 Jan. 1987, G. Marquet coll. - MNHN 1992-114, 2 females, 1 unsexed (26.2-28.8 mm); Ua Pou: Paaumea River, 22 Dec. 1986, G. Marquet coll. - MNHN 2004-1277, 15 ex.; Hiva Oa: Vaioa River, 13 Feb. 2000, Keith *et al.* coll.

Sicyopus (Smilosicyopus) fehlmanni Parenti & Maciolek, 1993. - Caroline Islands: Belau, Babelthuap Island, CAS-SU 52024, 13 males, 20 females, 1 juvenile (15.4-40.2 mm); south fork Arakitaoh Stream, 2.2 km southeast of Ngarekeai Village, 26 Nov. 1956, Sumang *et al.* coll. - CAS-SU 69693, 16 males, 29 females (18.9-33.4 mm); Ngardmau Municipality: north fork Amekaud River, 10 Oct. 1957, Sumang *et al.* coll.

Sicyopus (Smilosicyopus) leprurus Sakai & Nakamura, 1979. - Japan: Ryukyu Islands, Okinawa Prefecture, Ishigaki Island, BLIH 1983170, 5 males, 1 female (31.9-41.4 mm), Ishigaki City: Ara River, 10 Jul. 1983. - BLIH 1986407, male (30.5 mm), Ishigaki City: Ara River, 9 Sept. 1986. - BLIH 1987587, female (31.8 mm), Ishigaki City: Ara River, 10 Oct. 1987. - BLIH 1989135, male (29.5 mm). - BLIH 1989136, female (33.2 mm), Ishigaki City: Ara River, 17 Oct. 1989. - BLIH 1990727, female (30.1 mm), Ishigaki City: Ara River, 6 Oct. 1990. - NSMT P.28619, 2 males, 2 females; Ishigaki Island: Arakawa River, 2 Sept. 1974. - URM P4529, female (30.1 mm), 4 Sept. 1982.

Sicyopus (Smilosicyopus) chloe Watson, Keith & Marquet, 2001. - New Caledonia, MNHN 1996-262, male (33.9 mm), Wé Tite River, 23 Sept. 1991, PEDCAL coll. - BPBM 37406, female (32.4 mm), Cascade de Tao, 9 Oct. 1996, G. Marquet coll. - MNHN 1996-263, male (31.6 mm), Wé Tite River, 23 Sept. 1991, PEDCAL coll. - MNHN 2000-670, 2 females (25.9-34.3 mm), Cascade de Tao; 3 Apr. 1999, Chloé I Expedition. - SMF 28325, 2 females (26.8-32.3 mm), Cascade de Tao, 14 Dec. 1996, G. Marquet coll. - MNHN 2000-671, male (40.4 mm), Kokengoné River, 28 Oct. 1999, Chloé II Expedition. - MNHN 2000-672, 3 males, 3 females (24.0-27.9 mm), Tibarama River, station 3, 26 Oct. 1999, Chloé II Expedition. - MNHN 2000-673, female (21.2 mm), Narūma River, 26 Oct. 1999, Chloé II Expedition. - MNHN 2000-674, 1 male, 4 females (23.1-42.5 mm), tributary of Napoémien north of Napwéimié near Poindimié, 28 Oct. 1999, Chloé II Expedition. - UF 112009, 1 male, 1 female (31.4-33.1 mm), tributary of Napoémien north of Napwéimié near Poindimié, 4 Apr. 1999, Chloé I Expedition.

Sicyopus (Smilosicyopus) mystax, Watson & Allen, 1999. - Indonesia: Irian Jaya, MZB 9221, male (33 mm), Aiyindor River, 12 Jan. 1997, Allen coll. - WAM P.31262-004, 2 males, 2 females (30.4-40.4 mm).

S. mystax differs from all other *Sicyopus (Smilosicyopus)* including *S. sasali* in having 14 pectoral rays *versus* 15, and

in having no sexual dimorphism in jaw length; it is not included in tables I-IV.

SICYOPUS (SMILOSICYOPUS) SASALI, N. SP.

(Figs 1-3, Tabs I-IV)

Material examined

Eight specimens from Vanifao River of Futuna Island, totalling 3 males, 5 females, size range 26.41-43.51 mm SL

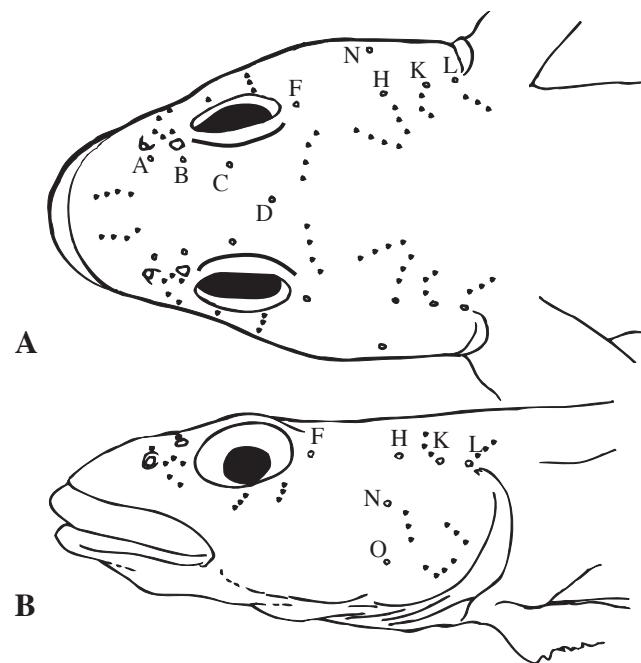


Figure 1. - Diagrammatic illustration of the head in *Sicyopus sasali* (MNHN 2004-3170) showing head pores and sensory papillae. A: Dorsal view; B: Lateral view. Scale bar = 5 mm. [Tête de *Sicyopus sasali* montrant les pores céphaliques et les papilles sensorielles. A : Vue dorsale ; B : Vue latérale. Échelle = 5 mm.]

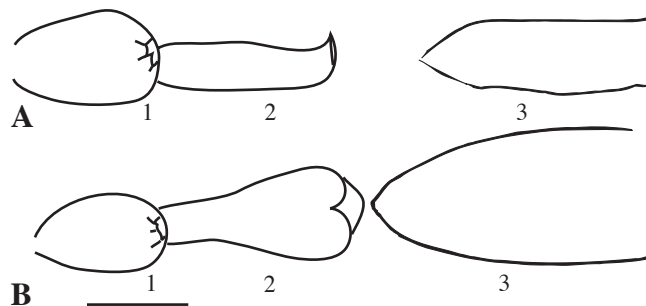


Figure 2. - Diagrammatic illustration of the urogenital papilla (ventral view) in *Sicyopus sasali*. A: Male (holotype, MNHN 2004-3170); B: Female (MNHN 2004-3171). 1: anus; 2: urogenital papilla; 3: anal fin. Scale bar = 1 mm. [Illustration de la papille urogénitale (vue ventrale) chez *Sicyopus sasali*. A : Mâle ; B : Femelle. 1 : anus ; 2 : papille urogénitale ; 3 : nageoire anale. Échelle = 1 mm.]

Table I. - Number of upper jaw teeth in *Sicyopus sasali* and related species. M: male; F: female. [Nombre de dents à la mâchoire supérieure chez *Sicyopus sasali* et chez les espèces proches. M : mâle ; F : femelle.]

	Upper jaw teeth														
	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
<i>S. sasali</i> M							1	-	2						
<i>S. sasali</i> F				1	-	-	2	-	1						
<i>S. chloe</i> M				1	1	2	1	-	-	1	2				
<i>S. chloe</i> F		1	4	1	3	4	1								
<i>S. bitaeniatus</i> M						1	-	-	-	-	1				
<i>S. bitaeniatus</i> F					3	1	1	3	1	2	-	-	-	1	
<i>S. fehlmanni</i> M		1	4	2	8	4	2	5	3	1					
<i>S. fehlmanni</i> F	1	5	8	11	12	5	7	2	4						
<i>S. leprurus</i> M		2	2	4	1	-	1								
<i>S. leprurus</i> F	1	-	1	-	3	2									

(30.3-51 mm (TL)), largest male 41.4, largest female 43.51 mm SL.

Holotype. - MNHN 2004-3170, male, Vanifao River, 147 m high, S 14.28339-W 178.13614, 15 Oct. 2004, Keith, Marquet, Sasal and Labrousse coll.

Paratypes. - MNHN 2004-3171, 2 males, 5 females, same data as holotype.

Diagnosis

A *Sicyopus* (*Smilosicyopus*) species, which is distinguished from the other species by the following set of characters: 15 pectoral rays; numerous scales in lateral series (24-47), transverse back series (3-13) and transverse forward series (0-13); few scales in zigzag series (11-14); a long second dorsal fin in males and a long anal fin; a short caudal peduncle and a short preanal length. A first large longitudinal black band from mouth to pectoral fin and from base of pectoral fin to caudal fin, a second from eye to pectoral fin and a third one in predorsal area.

Description

Scale counts in *S. sasali* and related species are given in table II, number of upper jaw teeth in table I, morphometrics in table III and fin length in table IV. Below, the holotype counts are given first, followed, in brackets, by the paratypes counts.

Dorsal fins D VI-I, 9 (VI-I, 9 (7)), spines 5-6 slightly filamentous in males and not in females, first dorsal fin not contacting second dorsal fin basally. Anal fin I,10 (I,9 (1), I,10 (6)). Pectoral fin rays 15, posterior margin rounded in female, pointed in male. Caudal fin 13 (13 (7)) branched rays, posterior margin rounded. Pelvic disc with 1 spine and 5 strongly branched rays, disc adherent to abdomen between fifth rays only. Scales in lateral series 30 (24-47) (Tab. II), may extend midlaterally over the origin of second dorsal fin and posteriorly to hypural base, scales usually cycloid, scales along dorsum usually

extend anteriorly along medial base of second dorsal fin (may extend to base of first dorsal fin). Scales in zigzag series 11 (11-14), transverse back series 11 (3-13), transverse forward series 0 (0-13) (Tab. II). Predorsal midline usually naked (one specimen (female) with 4 predorsal scales). Head, breast, belly and pectoral base, naked. Upper jaw teeth mostly conical (range 15-20), 2 or 3 canines present laterally, females modally with fewer teeth than males. Lower jaw teeth conical (range 9-12), single canine tooth usually present laterally (1-2), females modally with fewer teeth than males (Tab. I). Cephalic sensory pore system A, B, C, D, F, H, K, L, N and O, D singular, with all others paired, oculoscapular canal separated into anterior and posterior canals between pores H and K (Fig. 1). Cutaneous sensory

papillae developed on the head. Figure 2 gives the diagrammatic illustration of urogenital papilla. Urogenital papilla in male long and thin with a fairly pointed to rounded tip. Urogenital papilla in female with two lobes.

Colour in preservative

Sexual dichromatism not well developed.

Males. - Background of head and body greyish. Body blackish dorsal to midline, caudal peduncle blackish, body ventral to midline whitish. Blackish band posterior to eye and dorsal to pectoral base. Nape greyish with anterior to first dorsal fin a short blackish band. From tip of snout and upper lip a blackish band extending to posterior edge of opercle and pectoral base. From pectoral base a blackish band extending to caudal fin. Snout dusky. First and second dorsal fins slightly dusky, distal margin slightly dusky. Caudal fin with blackish medial band from base extending to half of posterior edge. Anal fin clear basally becoming slightly dusky distally with blackish margin. Pelvic disc clear with some dusky pigment. Pectoral fin with blackish band medially becoming slightly dusky distally, ventrally and dorsally mostly without pigment. Pectoral base blackish medially, slightly dusky dorsally and ventrally.

Females. - Background of head and body greyish, laterally with evenly spaced dusky bars becoming blackish midlaterally. First dorsal fin dusky. Nape slightly dusky with anterior to first dorsal fin a short blackish band. Blackish band posterior to eye and dorsal to pectoral base. Background of head greyish, a blackish medially bar from tip of snout and upper lip to posterior edge of opercle and pectoral base. From pectoral base a blackish band extending to caudal fin. Ventrally head mostly without pigment. First and second dorsal fins slightly dusky. Anal fin with rays and spine mostly without pigment, membrane clear. Pelvic disc clear. Pectoral fin rays dusky. Pectoral base slightly dusky.

Table II. - Scale counts in *Sicyopus sasali* and related species. [Nombre d'écaillles dans les diverses séries chez *Sicyopus sasali* et chez les espèces proches.]

	Lateral series																																														
	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47											
<i>S. sasali</i>													1	1	-	-	-	-	2	-	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1											
<i>S. chloe</i>	1	-	1	1	2	2	2	3	-	3	-	-	-	-	1	-	1	1	-	1	-	-	-	-	-	1																					
<i>S. bitaeniatus</i>																			1	2	1	-	1	-	2	1	2	1	-	1	-	-	-	-	1												
<i>S. fehlmanni</i>				9	5	4	8	8	6	4	6	6	4	8	4	-	-	1	2	1	1	-	1	-																							
<i>S. leprurus</i>					1	2	2	1	-	1	5	1	-	-	-	-	1	-	-	1	-	-	-	1																							

	Transverse series back																						
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
<i>S. sasali</i>				1	-	-	-	-	1	-	-	3	-	2									
<i>S. chloe</i>	20	-	1	1																			
<i>S. bitaeniatus</i>	15			2			1																
<i>S. fehlmanni</i>	49	-	1	7	2	3	2	-	1	1	4	1	2	1	1	-	1	1	-	-	1	1	1
<i>S. leprurus</i>	16	-	-	-	-	-	1																

	Zigzag series													Transverse series forward													
	9	10	11	12	13	14	15	16	17	18	19	20	21	0	1	2	3	4	5	6	7	8	9	10	11	12	13
<i>S. sasali</i>			1	4	-	2																					
<i>S. chloe</i>				1	2	6	3	6	2																		
<i>S. bitaeniatus</i>								2	6	1	3	-	1														
<i>S. fehlmanni</i>	2	15	16	26	12	8																					
<i>S. leprurus</i>		1	1	2	3	6	3																				

	Predorsal length													Caudal peduncle depth					Body depth at second dorsal fin origin in males																			
	33	34	35	36	37	38	39	40	41	42													9	10	11	12	13	14										
<i>S. sasali</i>				1	-	2	2	1	1	1					1	3	2	2						1	-	-	-	2										
<i>S. chloe</i>				2	3	9	2	5	-	1					2	11	9							2	2	4												
<i>S. bitaeniatus</i>					4	-	3	3	4						1	3	10								1	1												
<i>S. fehlmanni</i>				4	8	19	27	12	4	3	1				4	19	39	17						2	12	11	5											
<i>S. leprurus</i>	1	-	2	1	11	2									10	7							1	3	5	1												

	Head length							Caudal peduncle length																																
	22	23	24	25	26	27	28	12	13	14	15	16	17	18	19	20	21	22	23																					
<i>S. sasali</i>			1	3	3	1		1	2	-	2	2	-	1																										
<i>S. chloe</i>		5	7	8	1	1					1	1	2	3	11	2	2																							
<i>S. bitaeniatus</i>	1	1	5	1	4	1	1				1	5	6	-	1	-	1																							
<i>S. fehlmanni</i>	1	17	21	26	12	1						4	10	28	24	12	1	1																						
<i>S. leprurus</i>	1	3	5	4	3	1						1	4	6	5	1																								



Figure 3. - *Sicyopus sasali*. **A**: Male (holotype, MNHN 2004-3170) (photo: P. Keith); **B**: Female *in vivo*, not preserved (photo: J. Keith). [*Sicyopus sasali*. **A** : Mâle (holotype, MNHN 2004-3170) (photo: P. Keith) ; **B** : Femelle *in vivo*, non préservée (photo: J. Keith).]

Table IV. - Fin lengths in *Sicyopus sasali* and related species expressed to the nearest whole percent of standard length. M: male; F: female. [Longueur des nageoires chez *Sicyopus sasali* et chez les espèces proches exprimée en pourcentage de la longueur standard et arrondie au nombre entier le plus proche. M : mâle ; F : femelle.]

		Second dorsal fin length																																	
		22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	
<i>S. sasali</i> M																			1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	
<i>S. sasali</i> F			1	-	-	-	-	-	2	-	-	-	-	1	1																				
<i>S. chloe</i> M													1	3	1	-	1	1	-	1															
<i>S. chloe</i> F							2	5	2	1	3	1																							
<i>S. bitaeniatus</i> M													1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1			
<i>S. bitaeniatus</i> F							2	3	-	3	-	-	3	-	1	1																			
<i>S. fehlmanni</i> M											1	1	1	3	3	4	4	2	5	2	1	1	-	1	-	1									
<i>S. fehlmanni</i> F	1	-	-	1	4	12	7	9	8	4	4																								
<i>S. leprurus</i> M											1	-	-	-	-	-	-	1	-	3	1	1	1	1	-	1									
<i>S. leprurus</i> F						1	1	-	1	3	1																								

		Anal fin length																Caudal fin length															
		24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	16	17	18	19	20	21	22	23	24	25						
<i>S. sasali</i> M												1	-	2								1	-	1	1								
<i>S. sasali</i> F	1	-	1	-	-	-	-	1	1	1								1	-	2	-	-	2										
<i>S. chloe</i> M										2	1	2	1	1	1							4	1	1	1								
<i>S. chloe</i> F				1	-	3	3	6	1											1	-	1	4	6	2								
<i>S. bitaeniatus</i> M						1	-	-	1															1	1								
<i>S. bitaeniatus</i> F	2	1	2	1	3	2	1											1	-	-	2	-	8	-	1								
<i>S. fehlmanni</i> M						1	2	3	10	7	3	3	-	1	-	1					1	1	13	5	7	3							
<i>S. fehlmanni</i> F		1	-	3	21	19	6	1										1	-	3	6	19	12	4	5								
<i>S. leprurus</i> M						1	-	-	-	2	3	1	3									4	2	-	3	-	1						
<i>S. leprurus</i> F					4	2	1															1	4	1	-	1							

Colour in life

Body greyish to slightly yellowish. Three lateral bands present: first black band, extending from mouth to pectoral fin becoming wider from base of pectoral fin to base of caudal fin, a second from eye to pectoral fin and a third one in predorsal area. Dorsal fins and caudal fin dorsally and ventrally hyaline.

Males (Fig. 3A). - Pectoral fins and caudal fin brownish with a black medium band. Distal margin of anal fin whitish to bluish. Belly whitish to orange.

Females (Fig. 3B). - Pectoral fins greyish with a black medium band. Caudal fin blackish near caudal peduncle. Distal margin of anal fin whitish or hyaline. Belly bright orange or red in gravid female.

Distribution

Known only from streams of Futuna Island from 90 m to 200 m high.

Ecology

Like other Sicydiinae, *Sicyopus sasali* is found in clear, high gradient streams with rocky bottom. It lives on the bottom of the river, on top of rocks but it is also often seen swimming in open water in the current between rocks or in large pools.

Affinities

S. sasali differs from *S. chloe* in having more scales in lateral series (usually 24-47 *versus* 12-37), transverse back series (3-13 *versus* 0-3) and transverse forward series (0-13 *versus* 0), a shorter preanal length in male (56-59 *versus* 59-61) and a short black band on the middle of nape *versus* seven blackish spots on each side of nape. *Sicyopus sasali* differs from *S. leprurus* in having more scales in lateral series (usually 24-47 *versus* 16-35), transverse back series (3-13 *versus* 0) and transverse forward series (0-13 *versus* 0), and more upper jaw teeth in males (18-20 *versus* 13-18). *Sicyopus sasali* differs from *S. bitaeniatus* in having more scales in transverse back series (3-13 *versus* 0-6) and transverse forward series (0-13 *versus* 0-3), less scales in zigzag series (11-14 *versus* 16-21), a shorter preanal length in male (56-59 *versus* 58-62), and a larger anal fin length (34-36 *versus* 28-31). *Sicyopus sasali* differs from *S. fehlmanni* in having more scales in lateral series (usually 24-47 *versus* 14-33), and a larger jaw length (10-11 *versus* 8-10). *Sicyopus sasali* differs from all the species by a shorter caudal peduncle length.

Etymology

The name of the new species honours Pierre Sasal in appreciation of his extensive collection effort in the fresh waters of Futuna.

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